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**Wang et al.**

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(54) **EXPANDABLE RING DEVICE**

(56) **References Cited**

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U.S. PATENT DOCUMENTS

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4,911,683 A 3/1990 Legge et al.  
4,988,981 A 1/1991 Zimmerman et al.  
5,242,440 A \* 9/1993 Shippert ..... A61B 17/00  
200/DIG. 2  
5,354,162 A \* 10/1994 Burdea ..... A61F 5/0118  
414/4  
5,481,265 A \* 1/1996 Russell ..... A61F 4/00  
101/486  
5,489,922 A \* 2/1996 Zloof ..... G06F 3/0362  
345/156  
6,853,293 B2 \* 2/2005 Swartz ..... G06F 1/163  
235/462.15  
7,042,438 B2 \* 5/2006 McRae ..... A63F 13/06  
345/156  
8,086,971 B2 12/2011 Radivojevic et al.

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(58) **Field of Classification Search**  
CPC combination set(s) only.  
See application file for complete search history.

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(57) **ABSTRACT**

A system may include ring devices. A ring device may have a housing that is configured to be worn on a finger of a user. Sensors such as force sensors, ultrasonic sensors, inertial measurement units, optical sensors, touch sensors, and other components may be used in gathering input from a user. Control circuitry may wirelessly transmit information gathered from sensors and other input devices to an associated electronic device. The information may be used in controlling operation of the electronic device. The housing of the ring device may have an annular main body and an expandable portion coupled to the main body. The expandable portion may include a flap with a hinge, a rotatable housing member, a housing with an internal adjustable frame and a cover, an expandable housing formed from an expandable tube coupled between first and second annular devices, and other expandable structures.

**27 Claims, 20 Drawing Sheets**

